Revista de Psicología del Deporte 2013. Vol. 22, núm. 2, pp. 371-376
ISSN: 1132-239X

Universitat de les Illes Balears
Universitat Autònoma de Barcelona

BMI and self-perceived body shape in Portuguese children[1]

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BMI AND SELF-PERCEIVED BODY SHAPE AMONG PORTUGUESE CHILDREN

KEYWORDS: Body image, BMI, Children, Silhouettes.

ABSTRACT:

Objectives: This study examined the relationship between Portuguese children's self-perceived body shape and body mass index (BMI) by gender, and BMI values were determined for each silhouette.

Method: A sample of 4,211 children aged 7-10 was used. Their body image was assessed using Collins's body image silhouettes, while cole et al.'s cutoffs were used to define obesity.

Results: The higher the number of the selected silhouette, the higher the mean BMI, except in the case of silhouettes 2 and 7 for boys and 7 for girls. Most of the individuals who selected silhouette number 5 or higher were obese. For both sexes, the ANOVA showed significant differences in the BMI depending on the selected figures ($p < .001$). The correlation coefficient between the body image silhouettes and the BMI was .54 ($p < .001$) for the total sample, .50 ($p < .001$) for males and .57 ($p < .001$) for females. in the regression models, the percentage of variance in the BMI explained by the selected images was 25.6% in boys and 30.8% in girls.

Conclusion: The study suggested that in childhood (7-10 years), no stable awareness of body shape has been developed, with girls being more accurate than boys. The body shape obtained with the scale was moderately correlated with the BMI, suggesting that Collins' silhouettes could be a valid measure for assessing obesity in Portuguese children.

Body image was defined as "the picture we have in our minds of the size, shape and form of our bodies; and our feelings concerning these characteristics and our constituent body parts" (Slade, 1994). There has been a general consensus that an individual's image has two main components: perceptual and attitudinal (Gardner and Brown, 2010). The perceptual component involves the accuracy of body shape estimation and the attitudinal involves the feelings that individuals have toward their body. This study integrates the perceptual component of body image.

From very early on, young people have shown a great concern with body image. A study by Dohnt and Tiggemann (2006) found that body image concerns are relevant in young girls, aged 5-8 years. Dissatisfaction with body image in childhood can be considered as a risk factor for the development of some eating disorders, like anorexia or bulimia (Silva, Rego, Camila, Azevedo and Guerra, 2008).

There are many different scales that evaluate body image, one of the best-known being the *Stunkard's Figure Rating Scale* (Stunkard, Sorensen and Schlusinger, 1983). Based on adult figure drawing by Stunkard's, Collins (1991) developed a series of figure drawings incorporating both child and adult figures, male and female. Consisting of a series of seven figures, ranging from very thin to obese, in which participants rate which best represents their current and ideal body shape. We selected the *Collin's Scale* because it was developed specifically for children (Gardner and Brown, 2010), is one of the most commonly used (Smolak, 2004) and has a high test-retest reliability and criterion-related validity (Collins, 1991).

Most of the published studies on the relationship between *Body Mass Index* (BMI) and body image used adult samples (Bulik, et al., 2001; Cardinal, Kaciroti and Lumeng, 2006; Fitzgibbon, Blackman and Avellone, 2000; Gilbert-Diamond, Baylin, Mora-Plazas and Villamor, 2009; Kaufer-Horwitz, Martinez, Goti-Rodriguez and Avila-Rosas, 2006; Koprowski, Coates and Bernstein, 2001; Madrigal-Fritsch, et al., 1999; Osuna-Ramirez, Hernandez-Prado, Campuzano and Salmeron, 2006; Pulvers, et al., 2004; Sanchez-Villegas, et al., 2001; Tehard, van Liere, Com Nougue and Clavel-Chapelon, 2002). There are fewer studies with children (Banitt, et al., 2008; Coelho, Mourão-Carvalhal, Santos and Fonseca, 2010; Collins, 1991; Mciza, et al., 2005; Pallan, Hiam, Duda and Adab, 2011; Saxton, Hill, Chadwick and Wardle, 2009) and adolescents (Oliveira, Coelho, Fonseca and Mourão-Carvalhal, 2010; Wertheim, Paxton and Tilgner, 2004).

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[1] Contract grant sponsor: Fundação Ciência e Tecnologia POCTI/ESP/43238/2001.

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— *Fecha de recepción: 8 de Mayo de 2012. Fecha de aceptación: 1 de Diciembre de 2012.*

A study by Collins (1991), in order to present and validate the pictorial instrument to evaluate perceptions of body figure for children (average of 8 years old), found a correlation coefficient of .37 between pictorial self and BMI (criterion-related validity). An investigation by Mciza et al.(2005), of mothers and daughters (9-12 years) from South Africa, sought to validate an instrument to assess body image and found a positive correlation between BMI and body image, .46 for daughters and .68 for mothers. Banitt et al. (2008), in a study related to body image discrepancy, with African and Caucasian teenagers, verified the existence of a positive relationship between body image discrepancy and BMI - the increase in a unit on body image discrepancy was associated with a BMI increase of 4.84% in girls and an increase of 3.88% in boys. Saxton et al. (2009) with UK children (7-9 years old), found modest associations between weight status and body size perception, evaluated by Children Body Scale (r = .43), with stronger correlation in girls than boys (.49 vs. .32). A study by Coelho et al. (2010) in order to determine the association between body image and BMI in Portuguese children (6-18 years) concluded that young people do not have a good awareness of their body. The correlation value was .56 and increased with age. Recently, Pallan et al. (2011) found a positive association between body shape perception, evaluated by an adapted version of Collins'figure (Rand and Resnick, 2000), with weight status (.63) and BMI z-score (.21), adjusted for sex, age (5-7 years old) and ethnicity.

BMI is a simple, valid and reliable method to assess obesity in children and adolescents (Dietz and Bellizi, 1999), and an early diagnosis of overweight and obesity in childhood could be useful in the solution of this health problem, in order to implement preventive programs. In studies with large samples is difficult to collect directly the weight and height, being usually used the self-report BMI. This method of data collection implies some error from the underestimation of weight and the overestimation of height. In those cases, the body image assessment could be a more useful option to predict obesity. Then, the objective of this study was to determine the relationship between BMI and self-perceived body shape in Portuguese children, boys and girls, and to determine the BMI values that correspond to each silhouette.

Method

Sample

Subjects were selected from the population of children attending public schools. 94 schools were randomly selected in the districts and from each of them the participating children were selected using stratified randomization for age, with the aid of a table of random numbers. A total of 4211 were included, comprised of 2101 boys and 2110 girls, from ages 7 to 10 (8.46 ± 0.81). Some children were not included in our analysis because they were from others countries, had some kind of disabilities and due to missing data.

Instruments and Procedures

Measures of Body Image. Body shape perception was measured using a modified Stunkard Body Rate Scale developed by Collins (1991) for children. The pictorial consisted of seven images of boys and girls, each image corresponding to an increase in shape, from very thin (silhouette 1) to obese (silhouette 7). Subjects were asked to select an image that most looked like them - their current body shape. Children were tested individually in a private space at school.

Anthropometric Measures. Two trained technicians performed anthropometric measurements using a standardized procedure (WHO, 1995a, 1995b). Anthropometric measurements were performed with the children lightly dressed and without shoes. Height was measured using a stadiometer, with the head positioned according to the Frankfort plane; weight was measured using an electronic scale with a precision of 100 g.

BMI was calculated as weight/height^2 (Kg/m^2). The definitions of thinness, overweight and obesity were based on average centiles published by Cole et al. (2000; 2007). These cutoff points are linked to the widely accepted adult cutoff points of a BMI of 25 Kg/m^2 (overweight) and 30 Kg/m^2 (obesity).

The study protocol was approved by the Direcção Regional de Educação (Portuguese Institution of the Ministry of Education) and informed consent was previously obtained from all of the children's parents.

Statistical analysis

Mean, standard deviation, minimum and maximum values, percentage, mode and 95% confidence intervals were used to describe the general characteristics of the sample. The t test and Chi-Square test (χ^2) were used to compare BMI, age and obesity prevalence between gender, respectively. To evaluate differences in BMI by the figure chosen was applied an ANOVA. The Spearman correlation and a simple linear regression were selected to determine the relationship between self-perceived body shape and BMI. A significant level of .05 was used and all statistical analysis were carried out using IBM SPSS statistics 19.

Results

The general characteristics of the sample are presented in table 1.

Both boys and girls had identical in mean age values (8.5 ± 0.8). In fact, t test found no significant differences between genders (t (4359) = -.879, p = .379). Girls present significant higher BMI values than boys (t (4350.117) = -1.996, p = .046). The results of the χ^2 test showed significant differences in obesity between genders (χ^2 = 10.435, p = .015), girls presented higher prevalence.

Table 2 presents the sample distribution by gender, according to the selected silhouettes, the corresponding values of BMI (mean, standard deviation, 95% confidence intervals), and the percentage of obese individuals (including overweight and obese). 87.2% of the boys and 85.4% of the girls selected silhouettes 3, 4 and 5. In both genders, the mode was silhouette 4, with a corresponding BMI of 17.3. The mean BMI was higher when the number of the figure selected increased, except in silhouettes 2 and 7 for boys and 7 for girls. Most of the individuals who selected silhouette 5 or higher were obese.

The ANOVA showed significant differences in BMI by selected figures in both genders (F (6.22)= 179.03, p = .000 for boys, F (6.22) = 237.01, p = .000 for girls).

The correlation coefficient between body image silhouettes and BMI was .54 (p < .001) for the total sample, .50 (p < .001) for males and .57 (p < .001) for females.

	Mean	*SD*	Min.	Max.	Mode	%
Boys (*n* = 2101)						
Age (years)[a]	8.5	0.8	7.0	9.9	—	—
BMI (kg/m^2)[b]	17.9	3.0	9.5	35.8	—	—
Prevalence of obesity [c]						
- Thinness	—	—	—	—	—	3.5%
- Normal	—	—	—	—	—	66.8%
- Overweight	—	—	—	—	—	19.5%
- Obesity	—	—	—	—	—	10.3%
Girls (*n* = 2110)						
Age (years)[a]	8.5	0.8	7.0	9.9	—	—
BMI (kg/m^2)[b]	18.1	3.2	12.0	31.9	—	—
Prevalence of obesity [c]						
- Thinness	—	—	—	—	—	3.9%
- Normal	—	—	—	—	—	62.1%
- Overweight	—	—	—	—	—	21.6%
- Obesity	—	—	—	—	—	12.4%

[a] $p > .05$ (*t* test); [b] $p < .05$ (*t* test); [c] $p < .05$ (χ^2 test).

Table 1. General characteristics of the sample.

			BMI				
Image	**N**	**%**	**Mean**	***SD***	**Lower 95%CI**	**Upper 95%CI**	**% Obesity**
Boys [a]							
1	53	2.5	16.2	1.6	15.8	16.6	11.3
2	112	5.3	16.0	1.6	15.7	16.3	6.3
3	427	20.3	16.3	1.8	16.1	16.5	9.4
4	907	43.2	17.3	2.1	17.2	17.5	22.7
5	497	23.7	19.7	3.3	19.4	20.0	55.5
6	90	4.3	23.0	3.7	22.2	23.8	88.9
7	15	.7	22.1	5.9	18.9	25.4	66.7
Girls [b]							
1	66	3.1	15.8	2.0	15.3	16.3	18.2
2	125	5.9	16.0	1.9	15.7	16.3	8.8
3	405	19.2	16.4	2.0	16.2	16.6	10.9
4	868	41.1	17.3	2.3	17.1	17.5	22.0
5	529	25.1	20.1	3.0	19.9	20.4	66.2
6	105	5.0	23.7	3.1	23.1	24.3	94.3
7	12	0.6	23.3	4.8	20.2	26.4	75.0

[a] $p < .001$ (ANOVA); [b] $p < .001$ (ANOVA)

Tabel 2. Mean, 95% confidence intervals and percentage of obesity by gender for each silhouette.

	β	**T**	***p***	***r²***
Boys	.506	26.854	.000	.256
Girls	.555	30.659	.000	.308

Table 3: Linear regression between body image and BMI.

The linear regression models used to predict BMI were significant for both genders ($p < .001$) (see Table 3). The percentage of variance of BMI explained by selected images was 25.6% in boys and 30.8% in girls. The regression coefficient between BMI and self-perceived body shape was .506 ($p < .001$) for boys and .555 ($p < .001$) for girls.

Discussion

Significant differences were found in BMI and obesity prevalence by gender. In both variables, girls presented higher values. These results demonstrate that the cutoffs proposed by Tim Cole have a discriminate power in defining obesity, a fact confirmed by the higher fat mass percentage presented by females in all ages (Malina, Bouchard and Bar-Or, 2004). Also, Freedman et al. (2005) examined the relation of BMI to levels of fat mass and fat free mass among healthy 5-18 years old, and verified that levels of fat mass and fat mass index were higher among girls while fat free mass index levels were higher among boys.

Regarding body image, the majority of children which selected the silhouette 5 or higher were overweight or obese (55.5% in boys and 66.2% in girls), suggesting this figure as the cutoff to define overweight. As the cutoffs proposed by Cole et al. (2000) to define overweight and obesity for children are different every half year, between 2-18 years old, this figure (silhouette 5) should also be adjusted to gender and age to define overweight. During the growth and maturation process, dramatic changes occur in childhood and adolescence, namely BMI and the weight-height relation (Cole, et al., 2000; 2007).

There are cutoff values to define overweight and obesity based on silhouettes for adults (4 and 6, respectively, from nine silhouettes) (Bulik, et al., 2001; Kaufer-Horwitz, et al., 2006). However, as far as we know, there are no cutoff values for children. It will be necessary several regression equations to predict BMI adjusted for age and gender, whereas in adults two equations are enough because the cutoffs to define overweight and obesity (18.5 kg/m^2 and 25 kg/m^2) are the same for aged over 18 years.

Mean BMI gradually increased with silhouette number in both genders (confirmed by ANOVA), except for 2 and 7 images in boys and 7 in girls. The decrease in BMI between image 1 to 2 (16.2 kg/m^2 -16.0 kg/m^2) occurred in boys because it is difficult to discriminate the two silhouettes, fact also highlighted in a study by Kaufer-Horwitz et al. (2006), with adults female. BMI did not increase in both genders in the silhouette 7 due to the small number of children who selected this silhouette (0.7% in boys and 0.6% in girls); similar proportions were found in others investigations (Bulik, et al., 2001; Kaufer-Horwitz, et al., 2006). Collins developed a set of seven silhouettes in 1991, based on the Stunkard et al. (1983), and only in 1997 obesity was considered as an epidemic by the World Health Organization. In our opinion, as already proposed by Bulik et al. (2001) and implemented by Rand and Resnick (2000) e Rand and Wright (2000), it will be necessary to increase the number of images proposed by Collins in order to improve the discriminative power.

Correlation and regression results showed that children (7-10 years) do not have a good body shape perception. The moderate association (r = .53) between the self-perceived body shape and actual body, measured by BMI, was higher than others studies (Collins, 1991; Mciza, et al., 2005; Pallan, et al., 2011; Saxton, et al., 2009), which can be justified by the different methodological designs applied, cultural, ethnic and socioeconomic contexts. The correlation coefficients increases with age, in adolescents range between .65-.69 (Oliveira, et al., 2010; Wertheim, et al., 2004) and in adults between 0.64-0.87 (Bulik, et al., 2001; Cardinal, et al., 2006; Fitzgibbon, et al., 2000; Kaufer-Horwitz, et al., 2006; Koprowski, et al., 2001; Madrigal-Fritsch, et al., 1999; Osuna-Ramirez, et al., 2006; Pulvers, et al., 2004; Tehard, et al., 2002), showing a more accurate body shape perception. The body awareness is a dynamic process (Kinsbourne, 2002) that increases throughout the life-span, built from experiences.

In the regression analysis, girls showed a more accurate body shape perception (30.8% vs. 25.6% of BMI variance explained), results similar with Saxton et al. (2009). The social pressure and the girls' early puberty could be responsible for the higher concern about body shape in this gender.

A more positive body image perception is very important in the prevention of health problems (e.g. obesity, depression and eating disorders). Physical exercise, as a practical and widely accessible intervention, could also have an important role in this context (Campbell and Hausenblas, 2009; Hausenblas and Fallon, 2006).

Several limitations should be highlighted in this study and need to be kept in mind when analyzing these results. First, the complexity in defining cutoff values for overweight and obese children, based on the silhouettes. Second, some caution in the interpretation of extreme images. Third, there is no validation of Collin's scale silhouettes for Portuguese children. This study presents preliminary data to the construct validity. The next step will be the test-retest reliability and the discriminant validity, because there is a gap in this thematic.

Conclusions

In short, the present study suggested that in childhood (7-10 years) the body shape awareness is not stabilized, and girls are more accurate than boys. The body shape obtained by the scale was moderately correlated with BMI which suggested that Collins' figures could be a valid measure to assess obesity in Portuguese children. Future research needs to focus on extremely obese and thin children, as well as, other kinds of validation.

Declaration of interest

The authors report no declarations of interests.

IMC Y PERCEPCIÓN DE LA FORMA DEL CUERPO EN NIÑOS PORTUGUESES

PALABRAS CLAVE: Imagen corporal, Índice de masa corporal, Niños, Siluetas.
ABSTRACT:
Objetivos: Este estudio examinó la relación entre la percepción subjetiva forma del cuerpo (silueta) y el índice de masa corporal (IMC) en niños portugueses, de acuerdo con el género, y se determinaron los valores del IMC para cada una de las siluetas.
Método: Participó una muestra de 4211 niños, de entre 7 y 10 años de edad. La imagen corporal se evaluó utilizando las Siluetas de Imagen Corporal de Collins de la imagen corporal y se utilizaron las Curvas de Cole et al. para definir la obesidad.
Resultados: La media del IMC fue mayor cuando el número de la silueta seleccionado aumentaba, excepto en las siluetas 2 y 7 para los niños y para la 7 en las niñas. La mayoría de las personas que seleccionaron la silueta número 5 o superior eran obesos/as. El ANOVA mostró diferencias significativas en el IMC según las figuras seleccionadas en ambos sexos ($p < .001$). El coeficiente de correlación entre las siluetas de la imagen corporal y el IMC fue de .54 ($p < .001$) para la muestra total; de .50 ($p < .001$) para los niños, y de .57 ($p < .001$) para las niñas. En los modelos de regresión, el porcentaje de varianza explicada del IMC por las imágenes seleccionadas fue del 25.6% en los varones y del 30.8% en las niñas.
Conclusiones: El presente estudio sugiere que en la infancia (7-10 años), la conciencia de la forma del cuerpo no se halla estabilizada, y que las niñas son más precisas que los niños. La forma del cuerpo evaluado por la escala correlacionó moderadamente con el IMC, lo que sugiere que las Siluetas de Collins podrían ser una medida válida para evaluar la obesidad en niños portugueses.

IMC E PERCEPÇÃO DA IMAGEM CORPORAL EM CRIANÇAS PORTUGUESAS

PALAVRAS-CHAVE: Imagem Corporal, IMC, Crianças, Silhuetas.
RESUMO:
Objectivos: Verificar a relação entre a percepção da imagem corporal e o índice de massa corporal (IMC) em crianças portuguesas, de acordo com o género, e determinar os valores de IMC para cada silhueta.
Métodos: A amostra foi constituída por 4211 crianças, com idades entre os 7-10 anos. A imagem corporal foi avaliada através da escala de silhuetas de Collins e utilizados os valores de corte de Cole et al. para definir a prevalência de obesidade.
Resultados: A média do IMC aumenta à medida que o número da silhueta seleccionada também aumenta, excepto nas silhuetas 2 e 7 para os rapazes e 7 para as raparigas. A maioria dos indivíduos que seleccionaram a silhueta 5 ou superior são obesos. Os resultados da ANOVA mostraram diferenças significativas no IMC em função da silhueta seleccionada, em ambos os géneros ($p < .001$). O coeficiente de correlação entre as silhuetas da imagem corporal e o IMC foi de .54 ($p < .001$) para a amostra total, .50 ($p < .001$) para o sexo masculino e .57 ($p < .001$) para o feminino. Nos modelos de regressão, a variância do IMC explicada pelas imagens seleccionadas foi de 25.6% nos rapazes e 30.8% nas raparigas.
Conclusão: O presente estudo sugere que na infância (7-10 anos) a percepção da imagem corporal não está estabilizada, apresentando as raparigas uma maior precisão do que os rapazes. A percepção da imagem corporal correlacionou-se moderadamente com o IMC, o que sugere que a escala de silhuetas de Collins poderá ser uma medida válida para avaliar a obesidade em crianças portuguesas.

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